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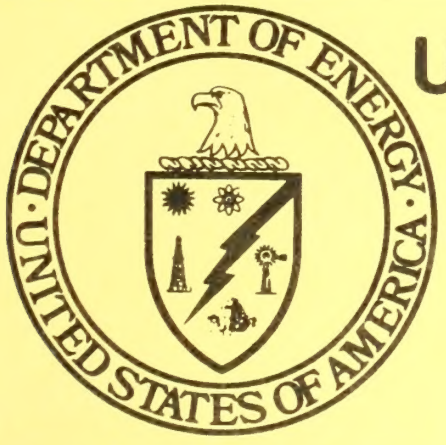
Monthly Performance Report

WASHINGTON NATURAL GAS COMPANY

MAY 1979



U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT

WASHINGTON NATURAL GAS COMPANY

MAY 1979

I. SYSTEM DESCRIPTION

The Washington Natural Gas Company site is a single-family residence in Kirkland, Washington. The home has approximately 2607 square feet of conditioned space. Solar energy is used for space heating the home and preheating domestic hot water (DHW). The solar energy system has an array of flat-plate collectors with a gross area of 591 square feet. The array faces south at an angle of 57 degrees to the horizontal. Air is the transfer medium that delivers solar energy from the collector array to storage and to the space heating and hot water loads. Solar energy is stored underground in a 273-cubic-foot bin containing 27,300 pounds of smooth stones. The bin has two inches of styrofoam insulation. Preheated city water is stored in an 80-gallon preheat storage tank and supplied, on demand, to a conventional 50-gallon DHW tank. When solar energy is insufficient to satisfy the space heating load, a gas furnace provides auxiliary energy for space heating. Similarly, a gas-fired unit in the DHW tank provides auxiliary energy for water heating. The system, shown schematically in Figure 1, has four modes of solar operation.

Mode 1 - Collector-to-Storage: This mode activates when there is no demand for space heating, and the temperature of the collector outlet exceeds that of the solar energy storage bin as measured by the control system sensors. Air circulates from the collector, through the air-to-liquid heat exchanger, through the air-handling unit and then through the solar energy storage bin to the collector. This mode exists as long as the temperature of the storage bin does not exceed 140°F.

Mode 2 - Storage-to-Space Heating: This mode activates when space heating is required, the solar insolation is insufficient to furnish the required energy

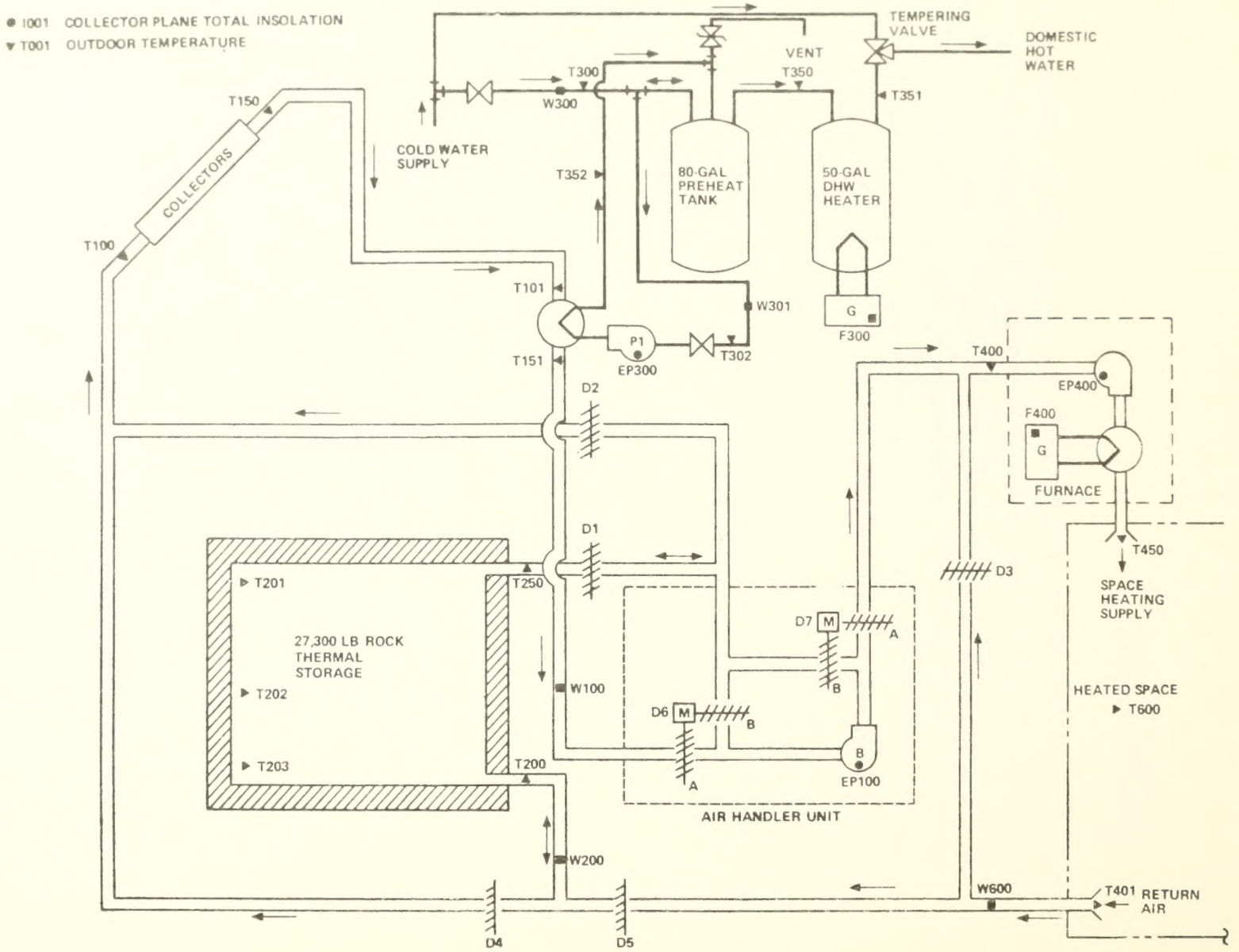

Figure 1. WASHINGTON NATURAL GAS SOLAR ENERGY SYSTEM SCHEMATIC

from the collector, and the temperature of the solar energy storage bin is higher than 90°F, as indicated by the control system sensors. Air circulates from the solar energy storage bin, through the air-handling unit and gas furnace, then returns to the storage bin, bypassing the collectors.

Mode 3 - Collector-to-DHW Tank: This mode activates during the summer when the collector outlet temperature is higher than the temperature of the water in the preheat tank as indicated by the control system sensors. Air circulates from the collector, through the air-to-liquid heat exchanger and the air-handling unit, and returns to the collectors, bypassing the solar energy storage bin. Domestic water preheating also occurs in modes 1 and 4.

Mode 4 - Collector-to-Space Heating: This mode activates when the collector is operating, and the plenum temperature at the top of storage, as indicated by the control system sensors, is higher than the minimum value suitable for supplying heat to the house. Heated air is circulated through the house by the air-handling unit before being returned to the collector.

II. PERFORMANCE EVALUATION

INTRODUCTION

The site was occupied in May and the solar energy system was operational during the entire month. Total solar energy collected was 4.7 million Btu and the total solar energy used was 0.59 million Btu or 13 percent of the collected energy. The change in stored energy was 0.075 million Btu and the total system losses amounted to 4.0 million Btu. Solar energy satisfied 58 percent of the DHW requirements. The solar energy system provided a fossil fuel energy savings of 0.98 million Btu and incurred an electrical energy expense of 0.43 million Btu. The air-flow sensor that senses the rate of air flow into and out of storage was inoperative all month.

WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 23.0 million Btu for a daily average of 1257 Btu per square foot. This was below the estimated average daily solar radiation for this geographical area during May of 1438 Btu per square foot for a south-facing plane with a tilt of 57 degrees to the horizontal. The average ambient temperature during May was 57°F as compared with the long-term average for May of 55°F. The number of heating degree-days for the month (based on a 65°F reference) was 249, as compared with the long-term average of 313.

THERMAL PERFORMANCE

System - During May the solar energy system performed somewhat poorer than expected. The expected performance was determined from a modified f-chart analysis using measured weather and subsystem loads as input. Solar energy used by the system was estimated by assuming that all energy collected would be applied to the load. Actual solar energy used was 0.59 million Btu versus an estimated 1.0 million Btu. System total solar fraction was 56 percent versus an estimated 100 percent.

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Collector - The total incident solar radiation on the collector array for the month of May was 23.0 million Btu. During the period the collector loop was operating, the total insolation amounted to 16.4 million Btu. The total collected solar energy for the month of May was 4.7 million Btu, resulting in a collector array efficiency of 20 percent, based on total incident insolation. Solar energy delivered from the collector array to storage was unknown because of an inoperable air-flow sensor. Operating energy required by the collector loop was 0.39 million Btu.

Storage - The amount of solar energy delivered to or taken from storage could not be calculated due to an inoperative air-flow sensor.

http://archive.org/details/monper7963unit

DHW Load - The DHW subsystem consumed 0.59 million Btu of solar energy and 0.67 million Btu of auxiliary fossil fuel energy to satisfy a hot water load of 0.99 million Btu. This resulted in a fossil fuel energy savings of 0.98 million Btu. The solar fraction of this load was 58 percent. The DHW subsystem consumed a total of 0.040 million Btu of operating energy, resulting in an electrical energy expense of 0.040 million Btu. A daily average of 55 gallons of DHW was consumed at an average temperature of 129°F delivered from the tank.

Space Heating Load - The space heating subsystem consumed 0.096 million Btu of auxiliary fossil fuel energy to satisfy a space heating load of 0.058 million Btu. The space heating subsystem consumed a total of 0.008 million Btu of operating energy. The amount of solar energy consumed by the space heating load is unknown because of an inoperative air-flow sensor.

OBSERVATIONS

The flowscanner (W301), which measures the amount of flow in the collector to DHW heat exchanger, was removed from the system by Boeing on April 30 because it was malfunctioning. The flowscanner remained out of the system for the entire month of May. The software was modified to calculate the amount of solar energy used by the DHW subsystem.

The air-flow sensor (W200), located in the duct work at the bottom of rock storage, has been inoperative for the entire month of May. Therefore, the calculations for the amount of solar energy into and/or out of storage, as well as the solar energy to space heating and solar fraction of space heating, are all incorrect.

ENERGY SAVINGS

The solar energy system provided a total electrical energy expense of 0.43 million Btu and a total fossil fuel energy savings of 0.98 million Btu. The

DHW subsystem incurred an electrical energy expense of 0.04 million Btu and a fossil fuel energy savings of 0.98 million Btu.

III. ACTION STATUS

Boeing will replace the flowscanner when parts become available. At the same time they will check out the air-flow sensor, and put the solar energy system into its summer mode.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: WASHINGTON NATURAL GAS
REPORT PERIOD: MAY,1979

SOLAR/1002-79/05

SITE/SYSTEM DESCRIPTION:
THE WASHINGTON NATURAL GAS SOLAR HEATING SYSTEM PROVIDES SPACE HEATING AND HOT WATER. AUXILIARY ENERGY IS SUPPLIED BY A FURNANCE FOR SPACE HEATING ANC BY A GAS WATER HEATER FOR HOT WATER.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	23.038 MILLION BTU
	38982 BTU/SQ.FT.
COLLECTED SOLAR ENERGY	4.655 MILLION BTU
	7877 BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	57 DEGREES F
AVERAGE BUILDING TEMPERATURE	72 DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.03
ECSS OPERATING ENERGY	0.392 MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	0.440 MILLION BTU
TOTAL ENERGY CONSUMED	5.859 MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	0.986	0.058	N.A.	1.044 MILLION BTU
SOLAR FRACTION	58	0	N.A.	56 PERCENT
SOLAR ENERGY USED	0.586	0.000	N.A.	0.586 MILLION BTU
OPERATING ENERGY	0.040	0.008	N.A.	0.440 MILLION BTU
AUX. THERMAL ENERGY	0.400	0.058	N.A.	0.458 MILLION BTU
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A. MILLION BTU
AUX. FOSSIL FUEL	0.667	0.096	N.A.	0.763 MILLION BTU
ELECTRICAL SAVINGS	-0.040	0.000	N.A.	-0.432 MILLION BTU
FOSSIL SAVINGS	0.976	0.000	N.A.	0.976 MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.468

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: WASHINGTON NATURAL GAS
REPORT PERIOD: MAY,1979

SOLAR/1002-79/05

SITE/SYSTEM DESCRIPTION:
THE WASHINGTON NATURAL GAS SOLAR HEATING SYSTEM PROVIDES SPACE HEATING AND HOT WATER. AUXILIARY ENERGY IS SUPPLIED BY A FURNANCE FOR SPACE HEATING AND BY A GAS WATER HEATER FOR HOT WATER.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	24.306 GIGA JOULES
	442682 KJ/SQ.M.
COLLECTED SOLAR ENERGY	4.911 GIGA JOULES
	89450 KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	14 DEGREES C
AVERAGE BUILDING TEMPERATURE	22 DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.03
ECSS OPERATING ENERGY	0.414 GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	0.465 GIGA JOULES
TOTAL ENERGY CONSUMED	6.181 GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	1.040	0.061	N.A.	1.101 GIGA JOULES
SOLAR FRACTION	58	0	N.A.	56 PERCENT
SOLAR ENERGY USED	0.618	0.000	N.A.	0.618 GIGA JOULES
OPERATING ENERGY	0.042	0.009	N.A.	0.465 GIGA JOULES
AUX. THERMAL ENG	0.422	0.061	N.A.	0.483 GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
AUX. FOSSIL FUEL	0.704	0.101	N.A.	0.805 GIGA JOULES
ELECTRICAL SAVINGS	-0.042	0.000	N.A.	-0.456 GIGA JOULES
FOSSIL SAVINGS	1.030	0.000	N.A.	1.030 GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.468

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: WASHINGTON NATURAL GAS
REPORT PERIOD: MAY,1979

SOLAR/1002-79/05

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.093	54	0.012	N	0.000	N	0.126
2	0.729	56	0.009	O	0.013	O	0.012
3	0.479	58	0.011	T	0.008	T	0.023
4	0.467	55	0.014		0.009		0.029
5	0.513	53	0.038	A	0.006	A	0.073
6	0.670	52	0.011	P	0.012	P	0.016
7	0.847	55	0.029	P	0.015	P	0.035
8	0.857	54	0.032	L	0.015	L	0.038
9	0.514	54	0.031	I	0.008	I	0.060
10	0.606	53	0.021	C	0.010	C	0.034
11	0.562	54	0.044	A	0.009	A	0.078
12	0.721	55	0.042	B	0.015	B	0.059
13	0.929	58	0.053	L	0.016	L	0.057
14	1.268	62	0.012	E	0.022	E	0.010
15	0.838	58	0.018		0.015		0.021
16	0.644	56	0.012		0.010		0.019
17	0.753	55	0.016		0.013		0.022
18	0.797	56	0.019		0.015		0.024
19	1.023	56	0.019		0.017		0.018
20	0.849	58	0.030		0.016		0.035
21	0.991	62	0.023		0.017		0.023
22	0.839	62	0.034		0.013		0.040
23	0.608	64	0.005		0.010		0.008
24	0.961	63	0.036		0.017		0.037
25	0.914	65	0.016		0.018		0.017
26	0.501	58	0.000		0.005		0.000
27	0.673	52	0.000		0.009		0.000
28	0.658	52	0.000		0.011		0.000
29	0.735	55	0.000		0.011		0.000
30	1.027	58	0.000		0.018		0.000
31	0.971	63	0.000		0.017		0.000
SUM	23.038	-	0.586	N.A.	0.392	N.A.	-
AVG	0.743	57	0.019	N.A.	0.013	N.A.	0.025
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: WASHINGTON NATURAL GAS
REPORT PERIOD: MAY,1979

SOLAR/1002-79/05

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.093	0.000	0.000	55	0.000
2	0.729	0.574	0.184	62	0.252
3	0.479	0.223	0.064	63	0.133
4	0.467	0.284	0.093	59	0.199
5	0.513	0.240	0.070	*	0.137
6	0.670	0.474	0.142	57	0.212
7	0.847	0.583	0.178	63	0.210
8	0.857	0.598	0.187	58	0.218
9	0.514	0.278	0.084	57	0.162
10	0.606	0.362	0.108	56	0.178
11	0.562	0.299	0.093	61	0.166
12	0.721	0.538	0.170	61	0.236
13	0.929	0.741	0.254	62	0.274
14	1.268	1.075	0.326	68	0.257
15	0.838	0.674	0.184	69	0.220
16	0.644	0.450	0.132	61	0.205
17	0.753	0.606	0.166	64	0.221
18	0.797	0.602	0.153	62	0.191
19	1.023	0.843	0.220	63	0.215
20	0.849	0.658	0.174	67	0.206
21	0.991	0.825	0.219	69	0.221
22	0.839	0.548	0.135	68	0.161
23	0.608	0.317	0.066	67	0.108
24	0.961	0.798	0.219	69	0.228
25	0.914	0.763	0.205	73	0.224
26	0.501	0.188	0.055	61	0.109
27	0.673	0.384	0.102	58	0.151
28	0.658	0.330	0.081	56	0.123
29	0.735	0.465	0.138	60	0.188
30	1.027	0.854	0.238	66	0.232
31	0.971	0.811	0.216	72	0.222
SUM	23.038	16.387	4.655	-	-
AVG	0.743	0.529	0.150	63	0.202
NBSID	Q001		Q100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: WASHINGTON NATURAL GAS
REPORT PERICD: MAY, 1979

SOLAR/1002-79/05

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FRCM STORAGE MILLION BTU	CHANGE IN STCRED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.000	0.000	-0.063	126	1.000
2	0.000	C.000	0.013	120	1.000
3	0.000	C.CCO	-C.042	118	1.000
4	0.000	0.000	-0.014	113	1.000
5	0.000	C.000	0.004	112	1.000
6	0.000	0.000	0.009	113	1.000
7	0.000	0.000	0.020	115	1.000
8	0.000	C.000	C.022	118	1.000
9	0.000	C.000	-C.054	116	1.000
10	C.000	C.000	-0.006	111	1.000
11	0.000	C.000	-C.017	109	1.000
12	0.000	0.000	0.037	112	1.000
13	0.000	C.000	0.063	119	1.000
14	0.000	C.000	C.050	130	1.000
15	0.000	0.000	0.008	134	1.000
16	0.000	C.000	-C.033	131	1.000
17	0.000	C.000	0.016	131	1.000
18	C.000	C.000	-0.010	130	1.000
19	0.000	C.000	C.032	132	1.000
20	0.000	0.000	-0.010	134	1.000
21	C.000	C.000	0.035	136	1.000
22	0.000	0.000	-0.042	137	1.000
23	0.000	0.000	-0.050	128	1.000
24	0.000	C.000	C.068	130	1.000
25	0.000	C.000	C.021	137	1.000
26	C.000	C.000	-0.056	135	1.000
27	0.000	C.000	-C.023	128	1.000
28	0.000	0.000	-0.034	122	1.000
29	C.000	C.000	0.030	122	1.000
30	0.000	C.000	0.059	130	1.000
31	0.000	0.000	0.040	139	1.000
SUM	0.000	C.000	0.075	-	-
AVG	0.000	C.000	C.002	125	1.000
NBS ID	Q20C	C201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: WASHINGTON NATURAL GAS
REPORT PERIOD: MAY, 1979

SOLAR/1002-79/05

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.016	57	0.012	0.000	0.005	N	0.008	-0.000	0.020	63	123	25
2	0.021	52	0.009	0.001	0.012	O	0.020	-0.001	0.015	58	147	28
3	0.017	55	0.011	0.001	0.006	T	0.010	-0.001	0.018	57	145	24
4	0.026	54	0.014	0.001	0.012		0.021	-0.001	0.023	58	145	37
5	0.079	47	0.038	0.001	0.041	A	0.069	-0.001	0.063	57	143	112
6	0.026	50	0.011	0.001	0.016	P	0.026	-0.001	0.018	57	127	55
7	0.055	54	0.029	0.002	0.026	P	0.043	-0.002	0.049	56	128	99
8	0.060	54	0.032	0.002	0.028	L	0.047	-0.002	0.054	56	131	102
9	0.055	55	0.031	0.001	0.024	I	0.041	-0.001	0.051	59	128	96
10	0.040	51	0.021	0.001	0.019	C	0.032	-0.001	0.035	59	127	70
11	0.089	48	0.044	0.001	0.045	A	0.075	-0.001	0.074	57	129	152
12	0.095	42	0.042	0.002	0.052	B	0.087	-0.002	0.071	57	127	156
13	0.089	56	0.053	0.002	0.036	L	0.060	-0.002	0.089	56	125	154
14	0.033	54	0.012	0.003	0.021	E	0.035	-0.003	0.020	59	132	53
15	0.021	64	0.018	0.001	0.003		0.005	-0.001	0.030	60	125	37
16	0.014	75	0.012	0.001	0.002		0.003	-0.001	0.020	59	120	26
17	0.013	88	0.016	0.002	-0.003		-0.005	-0.002	0.027	59	122	24
18	0.023	84	0.019	0.002	0.004		0.006	-0.002	0.032	61	121	44
19	0.029	80	0.019	0.001	0.010		0.017	-0.001	0.031	64	122	57
20	0.040	76	0.030	0.002	0.011		0.018	-0.002	0.050	60	121	81
21	0.027	78	0.023	0.001	0.004		0.006	-0.001	0.039	59	124	48
22	0.047	78	0.034	0.001	0.013		0.021	-0.001	0.057	59	126	85
23	0.006	73	0.005	0.001	0.001		0.002	-0.001	0.008	61	126	10
24	0.045	75	0.036	0.001	0.009		0.015	-0.001	0.059	67	124	86
25	0.019	82	0.016	0.001	0.003		0.006	-0.001	0.026	59	130	33
26	0.000	0	0.000	0.001	0.000		0.000	-0.001	0.000	59	130	0
27	0.000	0	0.000	0.001	0.000		0.000	-0.001	0.000	59	130	0
28	0.000	0	0.000	0.001	0.000		0.000	-0.001	0.000	59	130	0
29	0.000	0	0.000	0.001	0.000		0.000	-0.001	0.000	59	130	0
30	0.000	0	0.000	0.001	0.000		0.000	-0.001	0.000	59	130	0
31	0.000	0	0.000	0.001	0.000		0.000	-0.001	0.000	59	130	0
SUM	0.986	-	0.586	0.040	0.400	N.A.	0.667	-0.040	0.976	-	-	1694
AVG	0.032	58	0.019	0.001	0.013	N.A.	0.022	-0.001	0.031	59	129	55
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: WASHINGTON NATURAL GAS
REPORT PERIOD: MAY,1979

SOLAR/1002-79/05

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.000	0	0.000	0.000	0.000	N	0.000	0.000	0.000	70	54
2	0.019	0	0.000	0.001	0.019	C	0.031	0.000	0.000	70	56
3	0.000	0	0.000	0.000	0.000	T	0.000	0.000	0.000	71	58
4	0.020	0	0.000	0.001	0.020		0.034	0.000	0.000	71	55
5	0.000	0	0.000	0.000	0.000	A	0.000	0.000	0.000	71	53
6	0.000	0	0.000	0.000	0.000	P	0.000	0.000	0.000	70	52
7	0.002	0	0.000	0.000	0.002	P	0.004	0.000	0.000	70	55
8	0.000	0	0.000	0.000	0.000	L	0.000	0.000	0.000	71	54
9	0.000	0	0.000	0.000	0.000	I	0.000	0.000	0.000	70	54
10	0.016	0	0.000	0.001	0.016	C	0.027	0.000	0.000	70	53
11	0.000	0	0.000	0.000	0.000	A	0.000	0.000	0.000	70	54
12	0.000	0	0.000	0.000	0.000	B	0.000	0.000	0.000	73	55
13	0.000	0	0.000	0.000	0.000	L	0.000	0.000	0.000	73	58
14	0.000	0	0.000	0.000	0.000	E	0.000	0.000	0.000	73	62
15	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	74	58
16	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	73	56
17	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	72	55
18	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	73	56
19	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	72	56
20	-0.000	0	0.000	0.000	-0.000		-0.000	0.000	0.000	71	58
21	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	74	62
22	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	76	62
23	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	76	64
24	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	77	63
25	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	78	65
26	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	77	58
27	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	71	52
28	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	68	52
29	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	69	55
30	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	71	58
31	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	74	63
SUM	0.058	-	0.000	0.003	0.058	N.A.	0.096	0.000	0.000	-	-
AVG	0.002	0	0.000	0.000	0.002	N.A.	0.003	0.000	0.000	72	57
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: WASHINGTON NATURAL GAS
REPORT PERIOD: MAY, 1979

SOLAR/1002-79/05

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	158	NOT APPLICABLE	54	55	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2	1234		56	62			
3	810		58	63			
4	790		55	59			
5	867		53	*			
6	1133		52	57			
7	1433		55	63			
8	1450		54	58			
9	870		54	57			
10	1026		53	56			
11	951		54	61			
12	1220		55	61			
13	1572		58	62			
14	2145		62	68			
15	1418		58	69			
16	1090		56	61			
17	1274		55	64			
18	1349		56	62			
19	1732		56	63			
20	1436		58	67			
21	1676		62	69			
22	1419		62	68			
23	1029		64	67			
24	1626		63	69			
25	1547		65	73			
26	848		58	61			
27	1138		52	58			
28	1114		52	56			
29	1244		55	60			
30	1738		58	66			
31	1643		63	72			
SUM	38982	N.A.	-	-	-	-	-
AVG	1257	N.A.	57	63	N.A.	N.A.	N.A.
NBS ID	Q001		N113			N115	N114

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